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Addenda to Bibliography of Hyper-Space and Non-Euclidean Geometry.

By George Bruce Halsted.

(This Journal, Vol. I, pp. 261–276, 384, 385.)

Titles marked * were furnished by J. C. Glashan, Ottowa, Canada.

* Page 261, fourth line from bottom, *before* Geometry, *insert* Appendix to.
* Page " " " " *after* Thompson, " Fourth Edition.

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*II. Originally published in part in Grunert's Archiv, 1863, under the title, "Essai d'une Exposition rationnelle des principes fondamentaux de la Géométrie élémentaire."

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*III. See Land, J. P. N.

16. DARBOUX, G.

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21. GENOCCHI, A.

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IV. Ueber das Riemann'sche Krümmungsmaass höherer Mannigfaltigkeiten. Zeitsch. für Math. u. Phys., XXIV, pp. 1–17, 65–82. Leipzig, 1879.

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XI. Le Funzioni metriche fondamentali negli Spazi di quante si vogliano Dimensioni e di curvatura costante. R. Accad. dei Lincei, serie 3ª, vol. I°. Roma. 8 Aprile, 1877. Translated into French in Math. Ann. XII, pp. 403–418.

51. Zöllner, J. C. F.

*III. On Space of Four Dimensions; Quarterly Journal of Science, vol. VIII, 1878, pp. 227–237. A description of the *Slade* experiments.

53. Günther, S.

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II. Recension von A. Harnack. Vierteljahrschrift für wiss. Philosophie, II, erstes Heft, pp. 119–126. Leipzig, 1878.

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*Also noticed in Mind, vol. II, 1877, p. 432, and reviewed by J. P. N. Land in vol. III, 1878, pp. 551–555.

59. NEWCOMB, S.

*III. Astronomy, p. 513. A brief note on the possibility of the insufficiency of the present statement of the Law of the Dissipation of Energy, should space have curvature in a fourth dimension and contain a finite number of square miles.

65. SCHMITZ–DUMONT.

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66. MUNRO, C. J.

I. No. 134 (6 pages.)

II. Nature, vol. XV, No. 391. April 26, 1877, p. 547.

III. "Inside Out." Nature, vol. XVIII, No. 448. May 30, 1878, p. 116.

67. YOUNG, G. P.

*The Relation which can be proved to subsist between the Area of a Plane Triangle and the Sum of the Angles, on the Hypothesis that Euclid's 12th Axiom is False. Read before the Canadian Institute, 25th February, 1860. Published in the Canadian Journal of Industry, Science and Art. New Series, vol. V, 1860, pp. 341–356. "I propose to prove in the present paper, that, if Euclid's 12th Axiom be supposed to fail in any case, a relation subsists between the area of a plane triangle and the sum of the angles. Call the area A, and the sum of the angles s; a right angle being taken as the unit of measure. Then $A = k\ (2 - s)$; k being a constant finite quantity, that is, a finite quantity that remains the same for all triangles. This formula may be considered as holding good even when Euclid's 12th Axiom is assumed to be true; only k is, in that case, infinite." This paper was drawn up without the slightest knowledge whatsoever that anything had ever before been written or spoken on the subject. Thus the name of Prof. G. P. Young must be added to those of Lobatchewsky and Bolyai as an independent discoverer of the possibility of a pseudo-spherical geometry. The proof, which is in the style of Euclid, is thoroughly elementary, even more so perhaps than Bolyai's, and, like his, is applied to but two of the three geometries of surfaces of constant curvature; the assumption of Euclid's Sixth Postulate in the very first proposition, shutting out spherical geometry. Omitting this proposition, the proof is easily extended to pan-geometry. It is worthy of notice that the proof begins with the very proposition on which Legendre attempted, in the twelfth edition of his Éléments de Géométrie, to found a demonstration of the theory of parallels.

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II. Recent Advances in Physical Science. Second edition. Introduc., pp. 5–6. London, 1876.

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74. HOFFMANN, J. J. G.

I. Das elfte Axiom der Elemente des Euclides. Halle, 1859.

75. DELBOEUF, J.

*I. Prolégomènes philosophiques de la Géométrie et solutions des postulats. Liége, 1860. An attempt to found the theory of parallels on the homogeneity of space; see Preface, pp. vi and vii. Homogeneity, as defined in the preface and as usually understood, is found to be insufficient (see pp. 144 and 145); in fact by homogeneous M. Delboeuf means both homogeneous and homaloid. He is thus really at one with the new geometry. See also *C.*, pp. 75–84.

76. RODWELL, G. F.

*I. On Space of Four Dimensions. Nature, vol. VIII, pp. 8 and 9, 1873. An attempt to realize (α) a condition of life in space of two dimensions, (β) by the addition of the element of diverse motions to our already known space, the condition of life in space of four dimensions.

77. WITTE, H. TH.

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*I. Sur les Definitions géométriques. Paris, 1871.

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*I. Kant und Helmholtz über den Ursprung und die Bedeutung der Raumanschauung und der geometrischen Axiome. Schauenburg, 1878.

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